

distance exceeding that of a corresponding dimension of the solder ball such that the insulator provides a visible accessible surface to a pickup member.

Claim 17 recites that the insulators are in the form of collars with each having a flat surface on the side facing the lower end of a corresponding pin.

These respective recitations in claims 1, 12 and 17 do not have a counterpart in the Suchiro et al. patent (Suchiro). Suchiro appears to describe use of an oxidized surface or coating to act using the words of Suchiro as a dam to block solder migration. In all the examples given by Suchiro, the oxidized surface or coating is on the pin component itself, and typically would be smaller in all lateral dimensions than that of any solder element on the component. Suchiro continuously refers to it as a layer of material. For Suchiro's purposes, his "dam" layer does not require any significant lateral thickness, as evidenced by most of the examples disclosed by Suchiro to illustrate his invention.

In contrast, the structures set forth in claims 1, 12, and 17, as a laterally extending collar or dimensioned member or with a flat surface, also can function, as explained on Page 9, lines '20 et seq. of the specification, for activating the vision equipment of the pick and place machine to direct the vacuum pickup to the collar-surrounded pin. The Examiner should appreciate that, nowadays, automating assembly of PCBs by machine populating of the boards is essential to remain competitive in this or for that matter any competitive marketplace. In addition, the enlarged collar can assist in assembly of the various parts of the component.

In all the Suchiro embodiments, even including Fig. 3 in which the dam appears slightly larger than the solder ball, the "dam" could not be used for a typical vacuum pickup in which the pin end must project forward. Hence, the advantages of the claimed arrangement of the invention as set forth in these claims cannot be achieved by the Suchiro arrangement, and moreover the Suchiro teachings would not lead the person of ordinary skill in the art to the claimed arrangements.

For these reasons, claims 1, 12, and 17, as well as all the claims dependent on those claims, are submitted to be allowable over the art of record and should be allowed.

The remaining rejected claim 30 was rejected on the Kennedy et al. (Kennedy) patent. It also has been amended to recite plural vias interacting with plural pins each having a discrete

insulator and a soldering member. In contrast, in Kennedy, a common insulator 32 supports all of the pins. There is no teaching in Kennedy that would allow the person of ordinary skill in the art to omit the common carrier 32 for the pins. It is also noted that claim 30 calls for a solder bond at the pin upper end and a reflowable soldering member at the lower pin end, whereas Kennedy seems to teach that the member 17 is a socket connector.

Hence, claim 30 is also submitted to be allowable over the cited art.

It is believed the present amendment places the case in condition for allowance and such action is earnestly solicited.

A check for \$252. is attached to cover the 6 extra independent claims

Respectfully submitted,
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1/14/03

SUMMARY OF TEXT AND STATUS OF ALL PENDING CLAIMS

1. (Amended) A surface mount contact for attachment to a circuit board, comprising:
an elongate electrically conductive pin defining a shaft having a longitudinal axis and
having an upper end and a lower end;
a pre-formed heat re-flowable bonding member attached to the lower end of the pin; and
a discrete insulator surrounding the shaft of the pin intermediate the upper and lower
ends and adjacent the pre-formed heat re-flowable bonding member,
said discrete insulator comprising a collar extending laterally from the shaft.
2. (Original Claim) The surface mount contact of Claim 1 wherein the pin has a
cylindrical cross-section.
3. (Original Claim) The surface mount contact of Claim 1 wherein the upper end of
the pin is formed with a head with an outer surface that is dimensioned to be positioned on, and
bonded to, a conductive pad on a circuit board, and the lower end of the pin is dimensioned and
configured to be attached to a lower circuit board.
4. (Indicated Allowable) A surface mount contact for attachment to a circuit board,
comprising:
an elongate electrically conductive pin defining a shaft having a longitudinal axis and
having an upper end and a lower end,
a pre-formed heat re-flowable bonding member attached to the lower end of the pin,
an insulator surrounding the shaft of the pin intermediate the upper and lower ends and
adjacent the pre-formed heat re-flowable bonding member,
the upper end of the pin being formed with a head with an outer surface that is
dimensioned to be positioned on, and bonded to, a conductive pad on a circuit board, and the
lower end of the pin being dimensioned and configured to be attached to a lower circuit board,
the head being formed with at least one channel that opens through an outer surface of
the head and a peripheral wall of the head.
5. (Amended) The surface mount contact of Claim 1 wherein the pin is provided with a
conductive shoulder between the upper end of the pin and the insulator for establishing a
predetermined vertical position along the longitudinal axis relative to a reference surface.
6. (Cancel)

7. (Original Claim) The surface mount contact of Claim 1 wherein the pre-formed heat re-flowable bonding member is a solder ball.

8. (Indicated Allowable) A surface mount contact for attachment to a circuit board, comprising:

an elongate electrically conductive pin defining a shaft having a longitudinal axis and having an upper end and a lower end;

a pre-formed heat re-flowable bonding member attached to the lower end of the pin,

an insulator surrounding the shaft of the pin intermediate the upper and lower ends and adjacent the pre-formed heat re-flowable bonding member,

the pre-formed heat re-flowable bonding member being a solder ball,

the insulator having a conductive pad formed on an upper surface thereof surrounding the shaft of the pin adjacent the pre-formed heat re-flowable bonding member.

9. (Original Claim) The surface mount contact of Claim 1 wherein the insulator is made of a high temperature plastic resin or a printed circuit board material.

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10. (Amended) The surface mount contact of Claim 1 wherein the insulator collar is press-fitted around the pin.

11. (Original Claim) The surface mount contact of Claim 1 wherein the pin is of copper or a copper alloy.

12. (Amended) A discrete surface mount contact for soldering to a circuit board, comprising:

an elongate electrically conductive pin defining a shaft having a longitudinal axis and having a free upper end and a lower end;

(R)
a pre-formed heat re-flowable solder ball soldered to and fully surrounding the lower end of the pin; and

a discrete insulator surrounding and permanently attached to the shaft of the pin adjacent the pre-formed solder ball and sealing the shaft against solder migration;

the insulator having a dimension extending in a lateral direction to a distance exceeding that of a corresponding dimension of the solder ball such that the insulator provides a visible accessible surface to a pickup member.

13. (Indicated Allowable) A discrete surface mount contact for soldering to a circuit board, comprising:

an elongate electrically conductive pin defining a shaft having a longitudinal axis and having a free upper end and a lower end,

a pre-formed heat re-flowable solder ball soldered to and fully surrounding the lower end of the pin,

a discrete insulator surrounding and permanently attached to the shaft of the pin adjacent the pre-formed solder ball and sealing the shaft against solder migration,

a discrete conductive collar mounted on and surrounding the shaft of the pin intermediate the insulator and upper end of the pin.

14. (Amended) The discrete surface mount contact of Claim 13 wherein the insulator has an outside diameter that exceeds the outside diameter of the solder ball.

15. (Original Claim) The discrete surface mount contact of Claim 13 wherein the diameter of the insulator is smaller than the diameter of the solder ball.

16. (Original Claim) The discrete surface mount contact of Claim 15 wherein the insulator is a coating on an intermediate position of the pin.

17 (Amended) A circuit board assembly comprising:
an upper circuit board having contact positions;
a plurality of discrete electrically conductive pins each having a shaft with upper and lower ends, the upper ends of each of the pins being attached to the upper circuit board at one of its contact positions and being arranged in a predetermined pattern;

a plurality of insulators in the form of collars each surrounding an intermediate position of the shaft of a corresponding pin, the collars each having a flat surface on the side facing the lower end of a corresponding pin;

a lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern; and

a plurality of conductive joints each formed by re-flow of a pre-formed heat re-flowable bonding member attached to the lower end of a corresponding pin, each conductive joint

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Original*

bonding the lower end of a corresponding pin and a corresponding conductive pad and forming an electro-mechanical bond therebetween.

18. (Original Claim) The circuit board assembly of Claim 17 wherein both the attachments of the pin upper ends and the conductive joints are solder joints, and the solder joints are physically separated from one another by their respective insulator such that the solders at the two joints do not commingle.

19. (Original Claim) The circuit board assembly of Claim 17 wherein the upper ends of the pins are inserted into corresponding vias in the upper circuit board and each pin has a conductive shoulder positioned between the insulator and the upper circuit board that establishes a predetermined longitudinal position of the pin relative to the upper circuit board.

20. (Indicated Allowable) A circuit board assembly comprising:

an upper circuit board having contact positions,

a plurality of discrete electrically conductive pins each having a shaft with upper and lower ends, the upper ends of each of the pins being attached to the upper circuit board at one of its contact positions and being arranged in a predetermined pattern,

a plurality of insulators each surrounding an intermediate position of the shaft of a corresponding pin,

a lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern,

a plurality of conductive joints each formed by re-flow of a pre-formed heat re-flowable bonding member attached to the lower end of a corresponding pin, each conductive joint bonding the lower end of a corresponding pin and a corresponding conductive pad and forming an electro-mechanical bond therebetween,

each insulator being formed with a second conductive pad that is bonded by a corresponding second solder joint to a corresponding second conductive pad on the upper circuit board.

21. (Indicated Allowable) A circuit board assembly comprising:

an upper circuit board having contact positions,

a plurality of discrete electrically conductive pins each having a shaft with upper and lower ends, the upper ends of each of the pins being attached to the upper circuit board at one of its contact positions and being arranged in a predetermined pattern,

a plurality of insulators each surrounding an intermediate position of the shaft of a corresponding pin,

a lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern,

a plurality of conductive joints each formed by re-flow of a pre-formed heat re-flowable bonding member attached to the lower end of a corresponding pin, each conductive joint bonding the lower end of a corresponding pin and a corresponding conductive pad and forming an electro-mechanical bond therebetween,

a first melting temperature of the solder in the solder joints of the pins to the contact position being above a second melting temperature of the solder in the solder joints that bond the lower ends of the pins to the conductive pads on the lower circuit board.

22. (Original Claim) The circuit board assembly of Claim 17 wherein the upper end of each pin is formed with a head with an outer surface that is dimensioned to be positioned on, and surface bonded to, a second conductive pad on the upper circuit board.

23. (Indicated Allowable) A circuit board assembly comprising:
an upper circuit board having contact positions,
a plurality of discrete electrically conductive pins each having a shaft with upper and lower ends, the upper ends of each of the pins being attached to the upper circuit board at one of its contact positions and being arranged in a predetermined pattern,

a plurality of insulators each surrounding an intermediate position of the shaft of a corresponding pin,

a lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern,

a plurality of conductive joints each formed by re-flow of a pre-formed heat re-flowable bonding member attached to the lower end of a corresponding pin, each conductive joint

bonding the lower end of a corresponding pin and a corresponding conductive pad and forming an electro-mechanical bond therebetween,

the upper end of each pin being formed with a head with an outer surface that is dimensioned to be positioned on, and surface bonded to, a second conductive pad on the upper circuit board,

the head being formed with at least one channel that opens through the outer surface of the head and a peripheral wall of the head.

24. (Original Claim) The circuit board assembly of Claim 17 wherein the pre-formed heat re-flowable bonding member is made of a material selected from the group consisting of Tin/Lead solder, Tin/Bismuth solder, conductive epoxy, brazing compound, welding compound and solder paste.

25. (Allowed) A circuit board assembly comprising:

a generally planar upper circuit board having spaced plated through vias;
a plurality of electrically conductive pins each having a shaft with upper and lower ends, the upper ends of the pins being inserted in and attached to the plated through holes in the upper circuit board by a plurality of first solder joints and being arranged in a predetermined pattern;

a plurality of discrete insulators each surrounding the shaft of a corresponding pin;
a generally planar lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern; and

a plurality of second solder joints formed by re-flowing a pre-formed heat re-flowable bonding member located on the side of the insulators facing the lower circuit board, each of the second solder joints bonding a lower end of a corresponding pin and a corresponding conductive pad, a first portion of the pins having lower ends that directly contact their corresponding conductive pads and a second portion of the pins having their lower ends spaced slightly above their corresponding conductive pads.

26. (Allowed) The circuit board assembly of Claim 25 wherein each of the lower ends of the pins are spaced from the bottom surface of their corresponding re-flowable bonding member by a thickness equal to about 0.010-0.020 inches.

27. (Allowed) The circuit board assembly of Claim 25 wherein the upper surface of the insulator has a conductive pad and the upper end of the pin extends above the conductive pad formed on the upper surface of the insulator.

28. (Allowed) The circuit board assembly of Claim 25 wherein each of the insulators separates the first and second solder joints such that their solders do not commingle.

29. (Allowed) The circuit board assembly of Claim 25 wherein each of the insulators comprises an insulating coating.

30. A circuit board assembly comprising:

a generally planar single-sided circuit board having a plurality of spaced vias each surrounded by an electrically-conductive trace on one of the board's sides;

a plurality of electrically conductive pins each having a shaft with upper and lower ends, the upper end of each of the pins being inserted in and solder bonded to one of the vias in the circuit board by a first solder joint that also electrically connects the pin to the trace;

a plurality of discrete insulators each surrounding the shaft of one of the pins intermediate its upper and lower ends;

a plurality of pre-formed heat re-flowable soldering members each located on the side of one of the insulators adjacent the lower pin end and soldered to and fully surrounding the lower end of the pin;

each discrete insulator sealing to the shaft and preventing solder migration between the first solder joint and the adjacent re-flowable soldering member.

CLAIMS WITH MARKINGS TO INDICATE CHANGES MADE

1. (Amended) A surface mount contact for attachment to a circuit board, comprising:
an elongate electrically conductive pin defining a shaft having a longitudinal axis and having an upper end and a lower end;
a pre-formed heat re-flowable bonding member attached to the lower end of the pin; and
[an] a discrete insulator surrounding the shaft of the pin intermediate the upper and lower ends and adjacent the pre-formed heat re-flowable bonding member.],
said discrete insulator comprising a collar extending laterally from the shaft.
5. (Amended) The surface mount contact of Claim 1 wherein the pin is provided with a conductive shoulder between the upper end of the pin and the insulator for establishing a predetermined vertical position along the longitudinal axis relative to a reference surface.
6. (Cancel)
10. (Amended) The surface mount contact of Claim [6] 1 wherein the insulator collar is press-fitted around the pin.
12. (Amended) A discrete surface mount contact for soldering to a circuit board, comprising:
an elongate electrically conductive pin defining a shaft having a longitudinal axis and having a free upper end and a lower end;
a pre-formed heat re-flowable solder ball soldered to and fully surrounding the lower end of the pin; and
a discrete insulator surrounding and permanently attached to the shaft of the pin adjacent the pre-formed solder ball and sealing the shaft against solder migration.] ;
the insulator having a dimension extending in a lateral direction to a distance exceeding that of a corresponding dimension of the solder ball such that the insulator provides a visible accessible surface to a pickup member.
14. (Amended) The discrete surface mount contact of Claim 13 wherein the [diameter of the] insulator has an outside diameter that exceeds the outside diameter of the solder ball.
- 17 (Amended) A circuit board assembly comprising:

an upper circuit board having contact positions;
a plurality of discrete electrically conductive pins each having a shaft with upper and lower ends, the upper ends of each of the pins being attached to the upper circuit board at one of its contact positions and being arranged in a predetermined pattern;

a plurality of insulators in the form of collars each surrounding an intermediate position of the shaft of a corresponding pin, the collars each having a flat surface on the side facing the lower end of a corresponding pin;

a lower circuit board opposing and generally parallel with the upper circuit board, the lower circuit board having a plurality of conductive pads arranged in the predetermined pattern; and

a plurality of conductive joints each formed by re-flow of a pre-formed heat re-flowable bonding member attached to the lower end of a corresponding pin, each conductive joint bonding the lower end of a corresponding pin and a corresponding conductive pad and forming an electro-mechanical bond therebetween.

30. (Amended) A circuit board assembly comprising:
a generally planar single-sided circuit board having a plurality of spaced vias [with at least one of the vias] each surrounded by an electrically-conductive trace on one of the board's sides;

[at least one] a plurality of electrically conductive [pin] pins each having a shaft with upper and lower ends, the upper end of each of the [pin] pins being inserted in and solder bonded to [the] one of the [via] vias in the circuit board by a first solder joint that also electrically connects the pin to the trace;

* a plurality of discrete [insulator] insulators each surrounding the shaft of one of the [pin] pins intermediate its upper and lower ends;

a plurality of pre-formed heat re-flowable soldering [member] members each located on the side of one of the [insulator] insulators adjacent the lower pin end and soldered to and fully surrounding the lower end of the pin;

[the] each discrete insulator sealing to the shaft and preventing solder migration between the first solder joint and the adjacent re-flowable soldering member.